**Chief Information Officer's Section**
**Office of the Governor**
**State of Utah**

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# *Utah Technical Architecture Definition*

## *Purpose*

Deploying IT resources without an architecture framework is like constructing a city without plans for rights of ways, utilities, zoning, building codes and a wide range of other services. Those plans and guidelines differentiate a well-planned city from one that sprang up, unplanned. A statewide technical architecture will enable and empower agencies to make better decisions about deploying technology resources. Its purpose is to provide a framework of principles, recommended best practices, migration and implementation strategies, and state standards that will direct the design, construction, deployment, and management of distributed information systems. The statewide technical architecture will help agencies develop a technology infrastructure that can cost effectively support rapid change in business processes across the state and enable requirements for interoperability among state information systems.

## *Benefits*

Why develop a statewide technical architecture? The principle benefits of developing a statewide architecture are better information, improved decision-making and cost reductions.

**Better Information**

The statewide technical architecture facilitates:

- *Cross-Agency Business Requirements* – Promotes the sharing of information across the state enterprise, and across agency boundaries.
- *Data Collection and Quality* – Suggests consistent methodologies for collecting and handling data, which can help state agencies improve data quality, and consequent opportunities for sharing data.
- *Improved Interoperability* – Enables interoperability at multiple levels within the organization and improved capabilities for sharing documents, graphics, reports, and improved cross-functionality of agency information systems and development methodologies.
- *Mission Alignment* – Includes strategic planning as a component for ensuring alignment with major state objectives and business drivers.
- *Public Access* – Promotes a consistent method for organizing and categorizing state architecture information, which results in consistent methods of presenting state information to external business partners and the public through the Internet.
- *Re-engineering Initiatives* – Defines common state business requirements and seeks to identify the processes required to support them. Common processes have the potential for reuse to support agency process engineering initiatives.

**Improved Decision Making**

The statewide technical architecture enables:

- *Faster Response to Changing Business Needs* – Information is available on the current IT environment. With an understanding of the current environment and clearly articulated target architecture, decision-making can progress more rapidly, and integrated solutions are easier to visualize.

- *Gap Analysis* – Highlights areas of overlooked or missing information that can then be translated into opportunities for IT solutions.

- *IT Capital Investment Planning* – Defines a target direction for future IT acquisitions, which will facilitate state capital investment decision-making.

- *Knowledge Base* – Provides state government with a readily available pool of knowledgeable IT resources to assist with informed IT decision making.

**Cost Reduction**
The statewide technical architecture facilitates:

- *Economies of Scale* – Identifies common state activities across state agencies, highlighting potential areas for cost savings.

- *Market* Research – Developing a state technical architecture requires constant monitoring of technology trends and practices for enterprise use. This research can be shared with state agencies, relieving them of the added burden and cost of evaluating this information on their own.

- *Resource Sharing* – Promotes sharing of IT staff and other technical resources among state agencies.

## *Risks*

What are the risks and costs of not developing a statewide technical architecture? Without a statewide technical architecture to guide system modernization and development efforts, there is no systematic way to preclude inconsistent system design and development decisions and the resulting losses in performance and incompatibility. The resulting impact to state government includes the following areas:

**Inability to Share Information** – Without state guidelines and standards, agencies will continue to have trouble in sharing information through technology.

**Incomplete Information** – The State does not currently have a commonly understood technical architecture. This results in incomplete information for decision making:

- State cross-agency business information is incomplete due to legacy stovepipe systems that cannot share information easily.

- State IT capital planning investment information is incomplete due to limited information on the current architecture environment, lack of accessible ongoing technology market research, and lack of a state target technical architecture.

- State government faces an increasing risk of making inappropriate and costly decisions, because of incomplete information.

**Slow Response to Change** – Without a state technical architecture, the state will continue to be slow to respond to required changes. A statewide technical architecture facilitates faster problem identification; faster containment of problems by quickly defining standards for implementation; and the potential for faster mobilization and decision-making.

## *Architecture Framework*

A statewide technical architecture framework is an organizing mechanism for managing the development, maintenance, and facilitated decision making of a statewide technical architecture. The framework provides a structure for organizing state resources, and for defining and managing state architecture activities.

The development of a state technical architecture is a continuing process of evaluating current solutions and seeking target solutions. The illustration in Figure 1 illustrates the components of the framework. The general process flows from business drivers to an overall strategic direction. There are many interrelated influences between architecture components and the influence of standards and transition processes as the architecture becomes an articulated strategic direction.

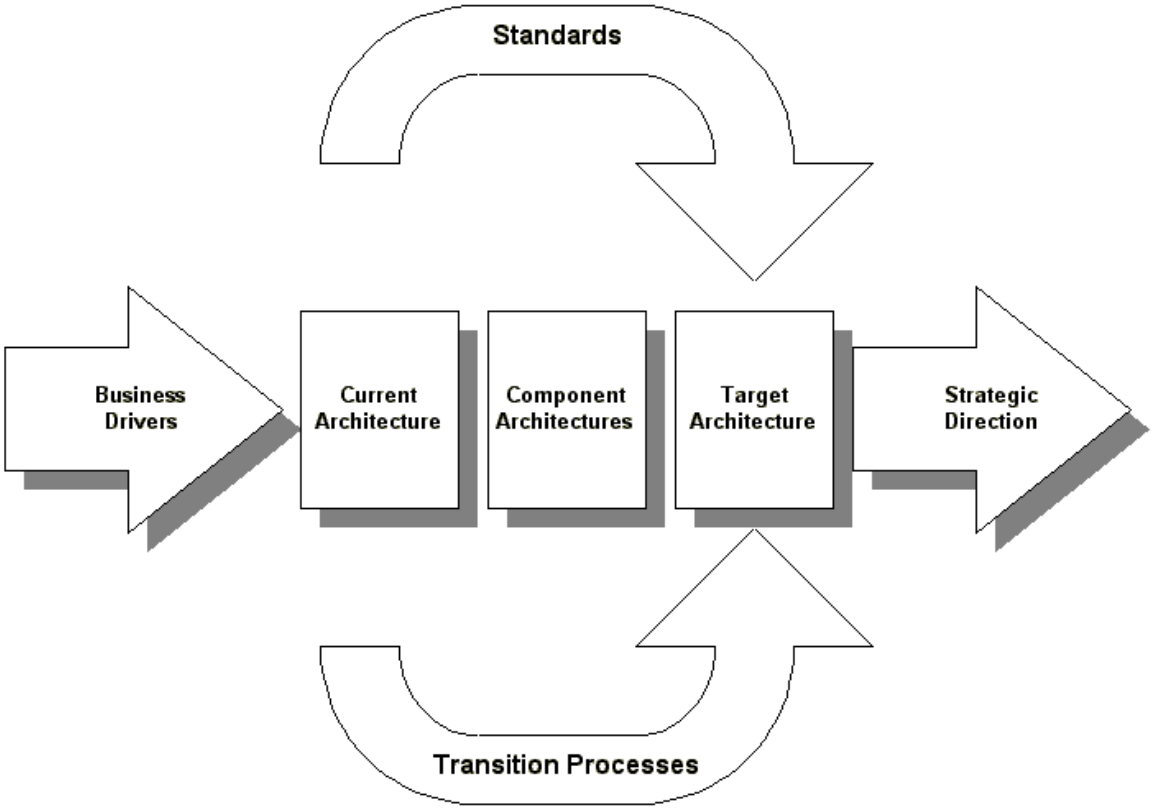


***Figure 1.*** *State Technical Architecture Framework*

The **Business Drivers** are the change agents for the enterprise architecture, and are of two types:

- *Business drivers,* such as the need for public access, state goals, objectives, and the various re-engineering activities impacting various agencies. These become core requirements for technical architecture.

- *Technology drivers,* such as the Internet and other important technology trends that impact customer expectations, and how the state will do business in the future.

The **Current Architecture** defines the current state, or baseline, for the enterprise, and consists of two parts:

- *Current business architecture,* which defines the current business needs being met by the current technology.

- *Current technology architecture,* which defines the currently implemented technology used for meeting the current state needs.

The **Target Architecture** defines the target state for the enterprise, and consists of two parts:

- *Target business architecture,* which defines the future business needs for the enterprise to be addressed through future technologies.

- *Target technology architecture,* which defines the future technologies to be used to meet the future business needs.

The **Component Architectures** consist of focused architecture efforts, such as a Collaboration and Workflow Architecture, and represent a portion of the overall enterprise architecture. Each architecture segment is composed of a current and target architecture segment.

The **Strategic Direction** guides the development of the target Architecture, and consists of:

- *Vision* which is a statement defining the targeted architecture such as the strategies embodied in the state IT plan.

- *Goals & objectives* for reaching the vision.

- *Principles* for guiding the architecture development.

**Transition Processes** are any processes, which support the migration from the current architecture to the target architecture.

**Standards** refer to all mandatory standards, guidelines, best practices, and configuration options for implementing the standards.

## *Background*

Information technology can assist government in restructuring operations and service delivery mechanisms. The state is experiencing new and serious challenges including citizen expectations for greater efficiency, implementation of new political initiatives from the legislature and other governmental entities external to the state, and an overall expectation of improved effectiveness of government programs.

The states present architecture and standards reflect the capabilities and application design approaches common to prior decades. Old systems, while serving the state well in the past, are difficult to modify as business requirements change. These same systems are expensive to modify to provide additional required features and functions. A new technical architecture is required to help the state become more adaptive to changing requirements and facilitate the improvement of business processes.

The framework of the proposed technology infrastructure is based on adaptive systems architecture concepts from the Meta Group and their Enterprise Architecture Standards Process (EAS) and the architecture development process currently employed by the Federal CIO Council. Adaptive systems are computer application systems that can be easily modified to support unanticipated changes in the business process that the application supports. Other relevant architecture projects as implemented in a number of other states using similar methodologies have also been reviewed and considered.

All of the components of the statewide technical architecture are derived from the goals in the state IT plan, *Utah's Strategic Information Plan: Making IT Happen!* and the Governor's goals for the state. These goals have been approved at an executive level within state government. They constitute the basis for the business drivers and the related technical architecture requirements. Business drivers are an influence that leads to requirements for technical architecture. They can include industry trends external to the enterprise, goals, objectives and requirements of business and IT managers, or changes to business processes.

## *Business Drivers*

The technical architecture of the state must help accomplish seven major objectives:

1. **It must facilitate the principle strategic objectives of the state IT plan.** The key goals of the state IT plan that impact requirements for technical architecture are as follows:

   - **Moving government on line.**
     a. Enable electronic commerce within state government.
     b. Coordinate electronic access to services and information.
     c. Build all future remote access applications using the Internet.
     d. Develop a state Intranet, with access to services and information pertinent to state employees.

   - **Become an integrated enterprise.**
     a. Establish cross-agency coordination teams to direct the coordination of IT efforts among agencies.
     b. Identify data that could be shared across agency boundaries.
     c. Identify ways to simplify or streamline processes and procedures that cross agency boundaries.
     d. Identify IT personnel who could serve as shared resources.
     e. Promote joint development and integration of IT systems.

   - **Manage and fund IT as a strategic investment.** Align budgeting and funding processes for IT with state and departmental goals and priorities.
     a. Incorporate IT into normal departmental budgeting and planning processes.

   - **Sharing data and information resources.**
     a. Establish an Architecture and Standards Technical Advisory Group.
     b. Establish a statewide data administration function.
     c. Establish a shared services organization.
     d. Develop an integrated network plan.

   - **Have the right people**. Develop processes and practices for attracting, retaining, and providing training opportunities for IT personnel.
     a. Allow skills to be more effectively leveraged across the entire state enterprise.

   - **Eliminate organizational barriers.** Optimize information technology and management structure.

2. **It must support the business and program priorities of state government.** The Governor has established six performance goals for the state:

   - Providing world-class education.
   - Creating quality jobs and a quality business environment.
   - Improving government services.
   - Enhancing the quality of life for all Utahns.
   - Fostering self-reliance.
   - Protecting Utah's foundation of community values.

   The Governor has also added as long-range goals for the state, to:

   - Slow the investment in bricks and mortar;
   - Refuel the settlement of rural Utah;
   - Use what we have better;
   - Increase individual responsibility and community values;

- Become a generation of planners; and
- Make quality our comparative advantage.

Technology investments must provide measurable improvements to public service and should facilitate the governor's goals for the state. Technology plays a direct role in helping to create a world-class educational system and has a significant impact on making government more efficient and effective. Technology can help make better use of existing resources, and can have a dramatic impact on our ability to plan and make quality of service and information a comparative advantage. The architecture must enable the development of systems that make state information and programs more accessible to the people of Utah and support the governors other performance goals for the state.

3. **It must enable new applications to be developed more rapidly and modified more easily as business requirements change.** New systems must be developed to accommodate rapid rates of change in the business and technical environments.

4. **It must support the use of information technology to continually improve government efficiency and effectiveness.** The new architecture must define appropriate technology standards, while still enabling old and new systems to work together. It must facilitate improvement in government efficiency.

5. **It must increase access to information and services for both citizens and government employees, while protecting privacy and fostering openness in government.** The architecture must enable easier access and more widely available information, while still protecting individual rights of privacy.

6. **It must enable agencies to continue to leverage the states existing technology infrastructure investment, while enabling a more efficient approach to implementing new systems.** New applications and enhancements to older systems will increasingly use reusable component and operate using commonly approved standards for data elements and common identifiers.

7. **It must enable agencies to use information technology as a catalyst to re-engineer current practices and design better ways of conducting the business of government.** The architecture should enable change and innovation and help create new possibilities for conducting government business.

## *Technology Trends*

Technology trends are an attempt to identify major technology directions that will have an impact on how technology will be used in the state. Each trend statement also contains implications of the associated trend.

- **Trend #1: Rapid creation of new technologies will shorten useful technology life**. The rapid rate of introduction of new technology will enable the state to meet new business needs more rapidly. At the same time the effects of this trend will shorten the useful life of the existing portfolio and could increase the total cost of ownership as products are changed.

- **Trend#2: The growth of Internet based commerce and the associated publicity will result in an increasing industry focus on security**. New and useful security products are appearing and will continue to appear. Acceptance of the Internet as a place to do business will continue to increase with internal and external pressures on the state to conduct increasing amounts of business in this channel. More emphasis will be placed on encryption and authentication.

- **Trend#3: Rapidly expanding use of Internet technology will be used to redesign and redefine business processes.** State business partners and customers will begin to expect and demand interaction and support over the Internet. New opportunities to reduce cost and/or create value will appear.

- **Trend#4: The Internet will drive the technical standards for applications and network computing.** There will be an increasing need to emphasize the use of Internet standards. The majority of new products, tools and approaches will be web and e-commerce focused. Web and Internet technologies will be pervasively used both inside and outside the organization. The browser will become the dominant interface for network applications. As these technologies continue to mature and become more secure they will drive the interaction with other states, federal and local government, and trading partners.

- **Trend#5: There will be a shortage of qualified IT Staff.** The general growth in new IT development has created a shortage of qualified IT personnel in specific areas and this will tend to drive up turnover rates and increase staffing costs.

- **Trend#6: The performance of computer hardware will continue to grow exponentially, while costs continue to decline dramatically.** This advance in semiconductor technology, known as Moore's Law, has been validated by experience over the past three decades. Now the scope of these advances includes all of computing technology, e.g. memory, disk storage, communications. This trend enables the state to exploit the technology curve and to get better price performance and unit costs on purchased services. The state will be challenged to manage the rollover and support of products with shorter life cycles, the pervasive use of computers in business and operational equipment, and the growth in network demand.

- **Trend#7: The telecommunications market will continue to evolve rapidly technically and at varied rates politically.** The network and telecommunications market is expected to continue to rapidly evolve and remain price competitive. The implications for the state are that demand will grow faster than the drop in unit costs, while gaps in our infrastructure will moderate our ability to exploit this trend.

- **Trend#8: The convergence of voice, data and video has begun and is accelerating.** Opportunities will exist to reduce costs and streamline service, but proactive surveillance will be required to identify and apply new opportunities.

- **Trend#9: New ways to connect to the computing environment are appearing.** As the state gains control of the desktop, a new set of challenges and opportunities will present themselves in the form of PDA's, hand held computers, electronic books, digital scribes, multi-function mobile devices, and wearable computers.

- **Trend#10: Application delivery will be increasingly component based.** The increasing failure of traditional software development methods is producing fundamentally new techniques for the execution of IT projects. Buy versus build, component-based development is becoming increasingly important. Human and technical infrastructure will need to adapt to be capable of supporting systemic reuse. Hardware required for projects will be overspecified rather than spending resources on engineering labor for fine-tuning.

- **Trend #11: "Intelligence" oriented technologies are becoming increasingly available.** Flexible tools and approaches are appearing in some areas that will present new sets of business opportunities. Important intelligence tools are appearing in dtat warehousing, knowledge management, analysis tools, language translation, etc.

- **Trend#12: Market forces will tend to dominate over superior technology**. Microsoft and Intel will dominate enterprise computing. UNIX will consolidate to three vendors and will be primarily server-side. Technology improvements will be incorporated into existing operating environments. Industry forecasts indicate the mainframe will diminish in relevance but will continue to be a large presence in the state, especially for large database applications.

- **Trend #13: High growth in data warehousing application and use.** Organizations are moving towards total digitization of all forms of corporate data and the creation of enterprise wide data warehouses. Data management and data migration still present significant challenges. Ready access to large volumes of internal data will provide valuable guidance to organizational decision-makers. Knowledge management, search and retrieval, workflow and data visualization will gain in importance.

- **Trend#14: The drive for interconnectivity and interoperability will blur traditional boundaries.** The need for systems to share data across agency boundaries will increase. Use of general state infrastructure resources to support agency specific applications will increase in importance.

- **Trend#15: Networking performance and capacity is growing more rapidly than Moore's law.** Bandwidth that is currently constrained will soon be widely available. TCP/IP and Ethernet will be the dominant network protocols.

- **Trend#16: Collaborative computing environments are enabling organizations to better marshall and focus their intellectual resources.** Multimedia collaboration tools are proliferating, as are tools for distributed, ad-hoc and communities of interest. More collaboration is taking place both inside and outside organizations.

- **Trend#17: Enterprises are using new technologies to reduce administration costs and establish a unified system management approach for corporate computing**. There is a trend toward more centrally administered computing. Server-centric business operations, and increasing use of network and system management tools are reflective of an enterprise desire to reassert control over IT.

## *Technical Architecture Requirements*

The following items are basic requirements for technical architecture (RTA's) that must be met by the technical architecture for the architecture to meet the needs and goals identified by the technology business drivers and objectives for the state.

- **RTA#1:** Include total cost of ownership and benefit analysis in component architecture development, migration plans, and product selection and product retirement.

- **RTA#2:** Include proactive enterprise-wide system and network management tools that support benchmarking, automation, monitoring and trouble-shooting.

- **RTA#3:** Deliver a modular, consistent, scalable and adaptive infrastructure.

- **RTA#4:** Minimize the number of standard configurations in order to reduce integration complexity.

- **RTA#5:** Be based on industry standards and market forces.

- **RTA#6:** Leverage network and hardware capacity investments to reduce people costs.

- **RTA#7:** Manage security and controls effectively and efficiently across the entire infrastructure.

- **RTA#8:** Drive towards a single statewide network and a consistent single sign on (SSO) access capability.

- **RTA#9:** Align with business needs. Anticipate demand for high leverage products and services delivering business benefit "just in time". Update plans on a regular basis to ensure alignment with changing business needs and technology trends.

- **RTA#10:** Provide high quality, consistent and stable products and services that can be effectively supported statewide.

- **RTA#11:** Deliver a unified "virtual" data center/server center with the capability to effectively support consolidation, standardization and automation.

- **RTA#12:** Identify and enforce effective technology standards and processes.

## *Component Architectures*

The technical architecture requirements for each of the seven major business drivers, the existing implied technical architecture of the state, and the impact of technology trends has been considered in suggesting a technical architecture for the state. Other documents are available that provide insight into current technology trends and practices in each component architecture area and in many cases dealing with specific technology components. Technology components of each architecture are preliminary and will be changed and revised as each architecture document is fully developed. The following seven interrelated architectures are the components of an Enterprise Wide Technical Architecture (EWTA) for the state of Utah:

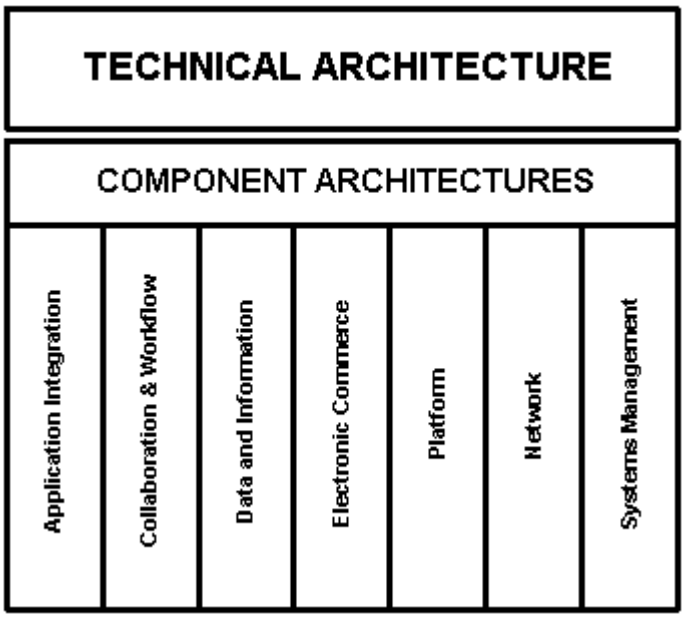


***Figure 2.*** *Statewide Technical Architecture Components*

### Application Architecture

***Scope:*** Application architecture identifies criteria and techniques associated with the design of applications that can be modified to respond to the state's changing business

needs. This architecture focuses upon client-server and web-centric applications development including Internet and Intranet applications; designing manageable applications, applications middleware; and project management tools and development methodologies. The architecture is composed of the following technology components:

- Client-server Application Architecture
- Application Communication Middleware
- Application Integration Architecture
- Web-centric Architecture (Internet/Intranet/Extranet)
- Application Manageability Architecture
- Object Architecture

## Collaboration and Workflow Architecture

***Scope:*** Collaboration and workflow architecture establishes a foundation for collaboration, communication, and workflow. Collaboration and workflow focuses on office and ad hoc workgroups, while communication focuses on sharing information both within and outside the state. The architecture is composed of the following technology components:

- Content Exchange Architecture
- Electronic Mail Architecture
- Calendaring and Scheduling Architecture
- Imaging Systems Architecture
- Workflow Architecture
- Enterprise Application Software Architecture

## Data and Information Architecture

***Scope:*** The data and information architecture provides high quality, consistent data for online transactional processing, where and when it is needed. The architecture also provides standards for accessing data for online analytical processing, including executive information systems and decision support systems. The architecture is composed of the following technology components:

- Database Management Systems Architecture
- Data Access Middleware Architecture
- Data Access Integration Architecture
- Data Warehouse Architecture
- Data Repository Architecture
- Data Hygiene Architecture
- Data Extraction and Transformation Architecture
- Data Replication Architecture
- Business Intelligence Architecture

## Electronic Commerce Architecture

***Scope:*** Electronic commerce architecture identifies electronic commerce implementation requirements and browser interfaces required to facilitate government commerce and on-line public access to government information and services. The architecture is composed of the following technology components:

- Card Verification and Payment Services Architecture
- Data Interchange (EDI) Architecture
- Electronic Funds Transfer Architecture
- Electronic Benefits Transfer Architecture
- Electronic Check Architecture
- Electronic Commerce Applications Architecture

## Platform Architecture

***Scope:*** Platform architecture identifies hardware and associated operating systems supporting the states client-server architecture. Platform architecture also identifies major associated hardware peripheral products. The architecture is initially composed of the following technology components:

- Mainframe Architecture
- Server Platform Architecture
- Client Platform Architecture
- Mass Storage Architecture
- Operating System Architecture

## Network Architecture

***Scope:*** The network architecture defines interconnectivity and provides the communication infrastructure for distributed applications and business locations. The architecture is composed of the following technology components:

- Local Area Network (LAN) Architecture
- Wide Area Network (WAN) Architecture
- Directory Services Architecture
- Network Centric Applications Architecture

## Systems Management Architecture

***Scope:*** Systems management architecture defines the framework for efficient and effective management of the state's information processing environment needed to support and enhance the productivity of it's automated business systems. The systems management architecture includes security. Security includes protection of the physical, intellectual, and electronic assets of the state, including its security policies, network access controls, virus protection, network administration, transaction security, and workstation security. The architecture is composed of the following technology components:

- Disaster Recovery and Contingency Planning Architecture
- Help Desk Architecture
- Operations Management Architecture
- Performance Monitoring and Tuning Architecture
- Security Architecture
- Storage Management Architecture
- Telecommunications Architecture

Based upon a review and consideration of the overall information infrastructure of the state it is suggested that the entire technology infrastructure can be addressed with these seven component architectures. The component architectures suggested exist at comparable levels of abstraction within the overall concept of a conceptual architecture and the architectures have many interrelationships as suggested by the Meta Group's EAS process.

These architecture recommendations place heavy emphasis on the concept of adaptability to change. More emphasis in relative terms has been placed on the capacity of the architecture to adapt quickly and economically to rapid changes in the business environment of the state. From a software development perspective, it is assumed that the state will build applications for specific kinds of business advantages and will buy applications to achieve parity. It is also assumed that all state information resources from data to applications code will evolve in a general direction of reuse by multiple agencies.

## *Implementation*

Each of the eight component architectures will be detailed in a separate document. The content outlines for each document have been adapted from the North Carolina Technical Architecture document as suggested by the Meta Group and by the Kentucky and Arizona architecture project methodologies. Language in these sections will include clear non-technical narrative and examples that can be understood by non-IT business managers as well as IT technical personnel. The architecture and the related technology components will contain the following topics as appropriate:

- **Scope Statement.** Provides a concise statement of the mission, scope and purpose of the specific architecture in the context of the state enterprise.

- **Introduction and Background.** This section will provide general background information and discuss important features or issues related to the state's implementation of the architecture. Principal business drivers and objectives that define the requirements for technical architecture are included in this section.

- **Principles.** This section will provide known principles and a rationale for adhering to those principles. It will serve as a starting point and guide the design and selection of technology components.

- **Recommended Best Practices.** This section identifies best practices related to the implementation of the architecture that have been identified in the architecture development process.

- **Technology Components.** This section identifies, defines and discusses the technical components supporting the specific architecture or architecture component. An example of technology components commonly related to Local Area Network (LAN) Architecture would be Topology, Protocol, Cabling, and Hubs and Switches. Each of these technology components would be discussed in the context of the architecture.

- **Migration and Implementation Approach.** This section describes the migration strategies for moving from existing technology components to technology supporting the new technical architecture adopted by the state. The section will specifically discuss what implementations to avoid; what applications are preferred and currently compliant; and what key emerging or future technologies may impact the architecture.

- **Standards.** This section identifies standards related to the specific architecture including relevant industry, national and international standards. Specific product standards will be identified whenever it is in the interest of the state to do so.

- **State Contracts.** This section outlines existing and planned contracts for procuring technical components within the specific architecture. Notice will also be indicated if no state contract is currently required.

- **Review Schedule.** Each architecture component will be subject to a review cycle for re-evaluation. Tentative review dates will be specified.

The eight component architectures will be developed based upon a judgement of priority within the overall architecture. Relationships between the component architectures will be assessed and decisions and recommendations made will be based in an overall architecture context. The result will be a practical document that clearly identifies strategies and standards for each of the component architectures. This information will facilitate agency decisions in selecting and implementing technology resources, and facilitate long term technology planning and investment decisions. Proper implementation of the architecture has the potential to significantly impact the efficient utilization of technology resources and the availability of information to government employees and citizens of the state.

Technology components of the architecture will include detailed technical documentation consistent with EWTA process recommendations and with the information requirements for RFP development. In addition to the previously mentioned documentation topics, each technology component will also include the following:

- **Business Drivers.** Business drivers unique to the technology component will be included.
- **Technical Requirements.** Technical requirements based upon business drivers and customer needs will be documented in this section.
- **Design and Technology Standards.** Specific standards and technology implementation documentation will be included in this section.
- **Product Specifications.** Product specification documentation will be included.
- **Configurations.** Configuration options consistent with the approved state standard will be specified.
- **Gap Analysis.** A detailed gap analysis will be included in support of the migration and implementation plan.

Since technology continues to change, the statewide technical architecture itself must remain current. There will be an ongoing evaluation of each architecture and its related technology components. Additional components will be added and projects related to maintaining and enhancing the development of a technical architecture will be initiated as needed.

## *Principles*

The following general principles have been identified in other state technical architecture projects, and by the Meta Group, to guide the design and identification of technical architecture components. Principles serve as an important starting point for the design and selection of technology components. While principles have strong general application, they are only relevant in the context of how the state prefers to implement statewide technology architecture.

**Principle 1: Development cycle times are getting shorter.** The rate of change in the business and administrative process of organizations is accelerating while cycle times for implementing new service delivery methodologies are getting shorter.

**Principle 2: Many business factors require shorter development cycle times**. Faster rates of change and shrinking cycle time are influenced by a wide range of factors, including pressure for lower state expenditures, increasing demand for government services, and higher citizen expectations for government services.

**Principle 3: New applications must be implemented more rapidly.** Faster rates of change and shorter cycle times require new applications to be implemented, and existing applications modified, at much faster rates.

**Principle 4: Existing infrastructure often gets in the way of rapid change.** The existing IT infrastructure of the state can inhibit the states ability to respond to shrinking cycle times. Some aspects of the states infrastructure are fixed and difficult to adapt to more demanding requirements.

**Principle 5: Facilitating easy and rapid change must be a principal design consideration of a technical infrastructure.** A primary design consideration for the statewide technical infrastructure must be implemented to enable change across the enterprise. Applications must be able to respond quickly to changes in business processes.

**Principle 6: Business and IT staff must have a common vision of both business and the role of technology in the business.** Adaptive systems require business organizations and IT staff to share a common vision of both the business and the role of technology in supporting the business.

**Principle 7: Business processes drive technical architectures.** The technical architectures of an adaptive system are driven by the business processes of the enterprise.

**Principle 8: Technical infrastructure enables business changes**. Fast changes in business processes are enabled, in part, by implementing a technical infrastructure that is broader than the immediate application requirements.

**Principle 9: Adaptive systems implementation must be statewide.** Adaptive systems must be implemented as a core business strategy on a statewide basis, rather than on an individual agency basis. This requires a common vision.

**Principle 10: Information must be pushed to users.** Organizations must evolve from a "pull" model of information access to a "push" model of information leverage.

**Principle 11: Technical architecture must easily integrate new technology and quickly meet demands for increased performance.** The technical architecture must be extensible and scaleable across the enterprise in order to achieve adaptive systems.

**Principle 12: The concept of adaptive systems must also apply to purchased applications.** Agencies should use adaptive systems concepts in the design of their technical architecture even if applications are to be purchased.

**Principle 13: Effective information delivery systems are required.** There is a great deal of leverage in the data already owed by the state. Consequently, strategies that implement strong and effective information delivery are required.

**Principle 14: Execute and implement infrastructure over capacity rather than under capacity.** Hardware costs associated with infrastructure are falling and capabilities are increasing. At the same time, personnel and development costs are escalating. Hardware and software investments should be increased to reduce IT staff requirements. Fixed investments should be oriented toward purchasing the most capacity or capability available within organizational financial limitations. This can create the lowest total cost of ownership while creating the greatest flexibility.

**Principle 15: Market forces, packaged solutions, industry standards, and overall integration will take precedence over individual product technical excellence.** Integration and interoperability are more important to the organization than using “best-in-class” but otherwise difficult to integrate products.

**Principle 16: Vendors, platforms, services, and configurations will be minimized.** Individual agency preferences will be respected within a standards framework. Every effort will be made to be sure that product selection diversity does not create manageability issues.

**Principle 17: Standard solutions will be delivered statewide through scalable and generally supported products.** Examples include GroupWise, NetWare, security products and mainframe and middleware products that are appropriate for enterprise use.

**Principle 18: Security and controls will be managed commensurate with risk.** Security implementations will be implemented to protect state technology assets with full

consideration of the level of risk or exposure to the state. Security requirements will be based on the sensitivity of the risk and the characteristics of the user base that access the application.

## *Best Practices*

The following are recommended best practices for developing technical architecture components that will facilitate the development of adaptive systems. Best practices do not necessarily fit all agencies or the entire state enterprise. They can be applied to any enterprise with varying levels of success. What works within the enterprise determines the appropriateness of any best practice. These practices are based upon architecture development experiences in other states and the recommendations of the Meta Group. They have been identified and included in the context of the states requirements for technical architecture.

**Recommended Best Practice 1: Unified architecture planning and management.** The planning and management of an enterprise technical architecture needs to be unified, even if application systems are implemented on a local agency basis.

**Recommended Best Practice 2: Reduce integration complexity.** The enterprise architecture needs to reduce integration complexity as much as possible.

**Recommended Best Practice 3: Use partitioned application designs.** Application systems and databases should be designed logically to be highly partitioned with clear logical boundaries that are not violated.

**Recommended Best Practice 4: Design interface to be message-based.** Design the interface between application systems and subsystems to be message-based and adhere to the logical boundaries.

**Recommended Best Practice 5: Design systems to be event-driven by actual business processes.** Business events must immediately initiate an action(s) such as sending a message and/or beginning a transaction in real-time. Triggers initiated by a database management system are a common approach. Agents also accomplish the same purpose.

**Recommended Best Practice 6: Send transaction messages in real-time.** Batch processes are not appropriate for sending transaction information between application systems and subsystems.

**Recommended Best Practice 7: Use granular platform designs**
Design platform design to be biased toward granularity or parallelism in physical servers. Server granularity facilitates the partitioning of application systems and databases and the preservation of logical boundaries. Granularity in servers significantly facilitates faster changes in business processes and standardization of server platforms.

**Recommended Best Practice 8: Separate transactions processing from executive information and decision support systems.** Physically separate transaction processing (OLTP) from decision support functions and on-line analytical processing (OLAP). This is the basis for an information warehouse strategy.

**Recommended Best Practice 9: Implement client-server systems.**
Implement application systems using a client-server model in which a desktop processor (client) employs a graphical user interface (GUI) to share application processing with a server(s) over a LAN. This is a thin client model. It improves system management since the application logic is on the server, not on every client.

**Recommended Best Practice 10: Implement an enterprise-wide communication network**. Implement an enterprise-wide, backbone communication network providing a single, network image to authorized users.

**Recommended Best Practice 11: Redefine the role of the programmer.** Redefine the domain of the programmer so that rapid, architected application development for both new requirements, as well as for changes to existing systems, can be achieved.

**Recommended Best Practice 12: Use granular application designs.** Design business rules and other recurring application logic in a consistent manner, encapsulated in a highly granular form, network based, and available across the enterprise under the control of a designated owner.

**Recommended Best Practice 13: Provide a data warehouse.** Provide an information warehouse in order to enable end user data access and reporting, and to improve decision making.

**Recommended Best Practice 14: Measure the contribution of information technology.** Implement performance measurements, measuring the contribution of IT to achieving the objectives of the state.

**Recommended Best Practice 15: Implement open systems.** Implement a consistent architecture, based on product, market, and industry standards, in order to achieve the objectives of open systems. Open standards do not exist for all parts of the architecture. A combination of de facto industry standards, product standards, and open standards will be required in order to support a diverse operating environment.

**Recommended Best Practice 16: Build for business advantage.** The state should build those applications that will provide business advantages and buy those applications that will provide parity.

**Recommended Best Practice 17: Share components and provide a repository for shared components.** Application systems should share reusable components across the enterprise, and the enterprise must provide a repository for reusable components.

**Recommended Best Practice 18: Comprehensive work architecture.** Evolve a comprehensive information architecture that encompasses the entire "work architecture" – process models, events, transaction data, state descriptions and so forth.

**Recommended Best Practice 19: When industry standards do not exist, use interim product standards.** Use product based standards as an interim solution for implementing specific architectures and components.

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